

3 Phosphorus TMDLs for WMA 5

Hackensack River and Pascack Brook Watersheds


August 9, 2005

**New Jersey Department of Environmental Protection
Division of Watershed Management
Bureau of Environmental Analysis and Restoration**

Frank Klapinski




Overview of Presentation

- What is a TMDL
 - Flow Integrated Reduction Methodology
 - TMDL Calculations for Impaired Segments
 - TMDL Implementation Measures
 - Summary
- 



What are TMDLs?

- Total Maximum Daily Loads (TMDLs) represent the assimilative or load capacity of the receiving water, taking into consideration:
 - point sources of pollutants (wasteload)
 - nonpoint sources of pollutants (load)
 - natural background
 - surface water withdrawals
- 

2004 Integrated List

305(b)
Report

SUBLIST 1 & 2: FULL ATTAINMENT

LIMITED ATTAINMENT DATA

SUBLIST 3: INSUFFICIENT DATA TO ASSESS

SUBLIST 4: IMPAIRED BUT:

TMDL Completed

IMPAIRMENT BY POLLUTION NOT POLLUTANT

OTHER ENFORCEABLE MEASURES WILL ADDRESS

SUBLIST 5: NON-ATTAINMENT

} 303(d) List

Establish & Implement TMDLs

- Establish TMDL in accordance with MOA schedule with EPA:
 - Propose TMDL as an amendment to water quality management plans (WQMPs)
 - Establish TMDL - submit to EPA for formal approval
 - Adopt TMDL as amendment to WQMP
- Implementation of Control Actions:
 - Issue water quality-based permits
 - Additional Measures per Phase 2 Stormwater Permits
 - Implement nonpoint source controls through funding from NJDEP as it is available (319H & CBT)

How are TMDLs expressed?

Amount of pollutants that a waterbody can assimilate without violating surface water quality standards or other target

$$\text{TMDL} = \sum \text{WLA} + \sum \text{LA} + \text{MOS}$$

Where:

WLA is the wasteload allocation

LA is the load allocation and

MOS is the margin of safety

Margin of Safety (MOS)

- A required component of the TMDL that accounts for any lack of knowledge concerning the relationship between effluent limitations and water quality (40 CFR 130.79(c))
- The MOS shall be expressed either as an internal modeling factor and/or as an explicit, separate factor (N.J.A.C. 7:15- 7.7(a))

Components of TMDL Document

- Source assessment
 - characterization and quantification as necessary
 - identify point, nonpoint and background sources
- Water quality analysis
 - link pollutant sources & water quality: model
 - consider seasonal variation / critical conditions
- TMDL calculations
 - loading capacity
 - margin of safety
 - load and wasteload allocations
- Follow-up monitoring
- Implementation
- Public participation

Target for TMDL: SWQS for Phosphorus (mg/L)

Numerical Criteria

- i. **Lakes:** TP not to exceed **0.05** in any lake, pond, reservoir, or in a tributary at the point where it enters such bodies of water, except where site-specific criteria are developed (N.J.A.C. 7:9B-1.5(g)3)
- ii. **Streams:** TP not to exceed **0.1** in any stream, unless it can be demonstrated that TP is not a limiting nutrient and will not otherwise render the waters unsuitable for the designated uses.

SWQS for Phosphorus (mg/L), continued

Narrative Criteria--Nutrient policies are as follows:

- Except as due to natural conditions, nutrients shall not be allowed in concentrations that cause objectionable algal densities, nuisance aquatic vegetation, abnormal diurnal fluctuations in dissolved oxygen or pH, changes to the composition of aquatic ecosystems, or otherwise render the waters unsuitable for the designated uses.

Summary of Data

- Phosphorus concentration: >10% results exceeded SWQS of 0.1 mg/L TP

Water Quality Sample Locations	Site Number	# of samples	Average (mg/L)	% exceeding 0.1 mg/L
Coles Brook at Hackensack	01378560	24	0.10	37.5%
Pascack Brook at Westwood	01377500	16	0.07	25%
Musquapsink Brook at River Vale	01377499	8	0.24	37.5%

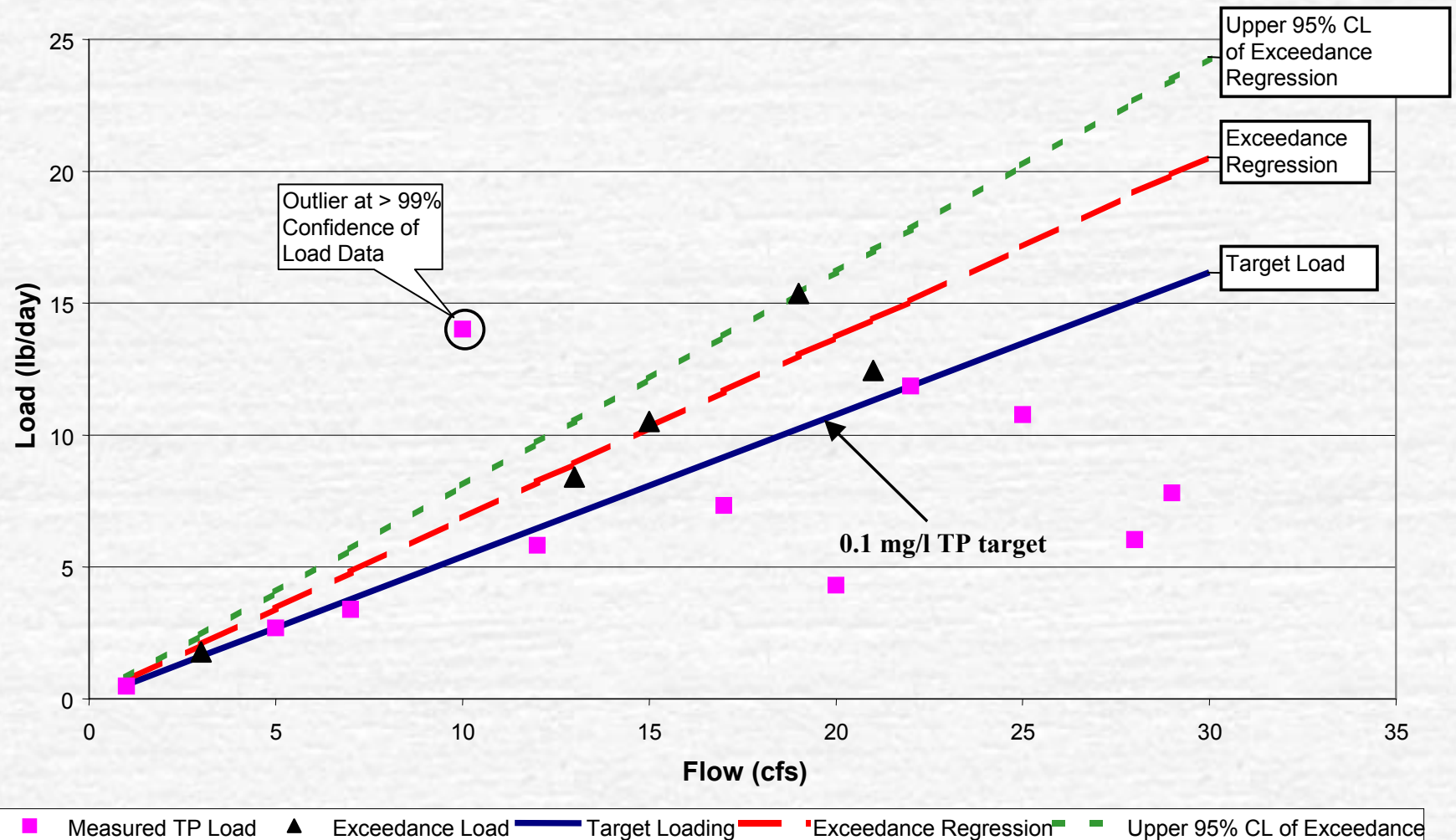
- Phosphorus could not be excluded as a limiting nutrient
- TMDL is Required

TMDL Model Used: Flow-Integrated Reduction of Exceedances (FIRE)

- Method must be selected to relate water quality to pollutant loading
- FIRE uses site-specific water quality concentration and flow data to determine the relationship between flow and load. The required reduction was calculated by comparing the site-specific relationship to the target relationship, which corresponds to attainment of the New Jersey Surface Water Standards.

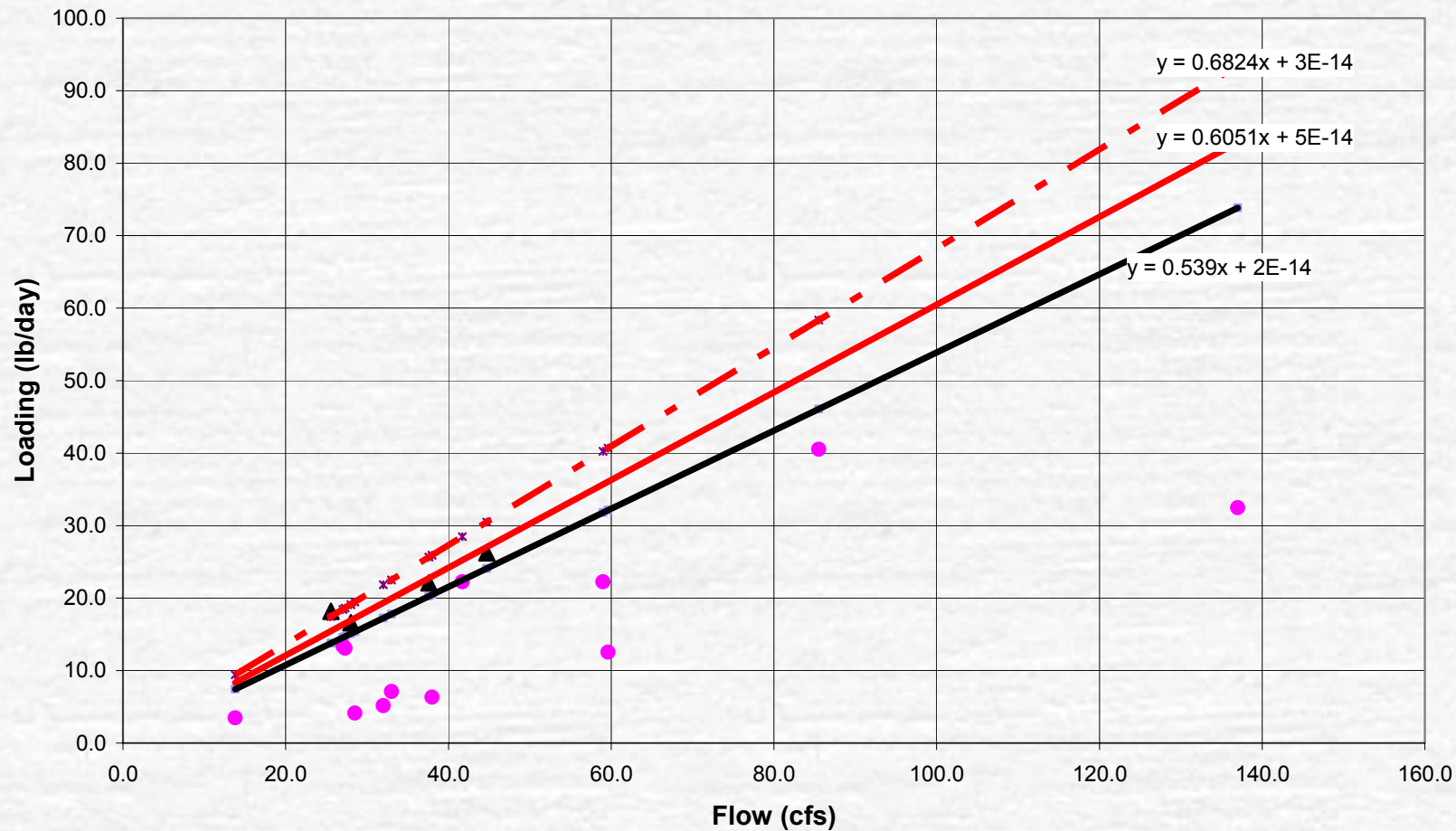
Illustrative Example of FIRE

Flow-Integrated Water Quality Exceedance Assessment (Hypothetical Total Phosphorus Data)



Pascack Brook

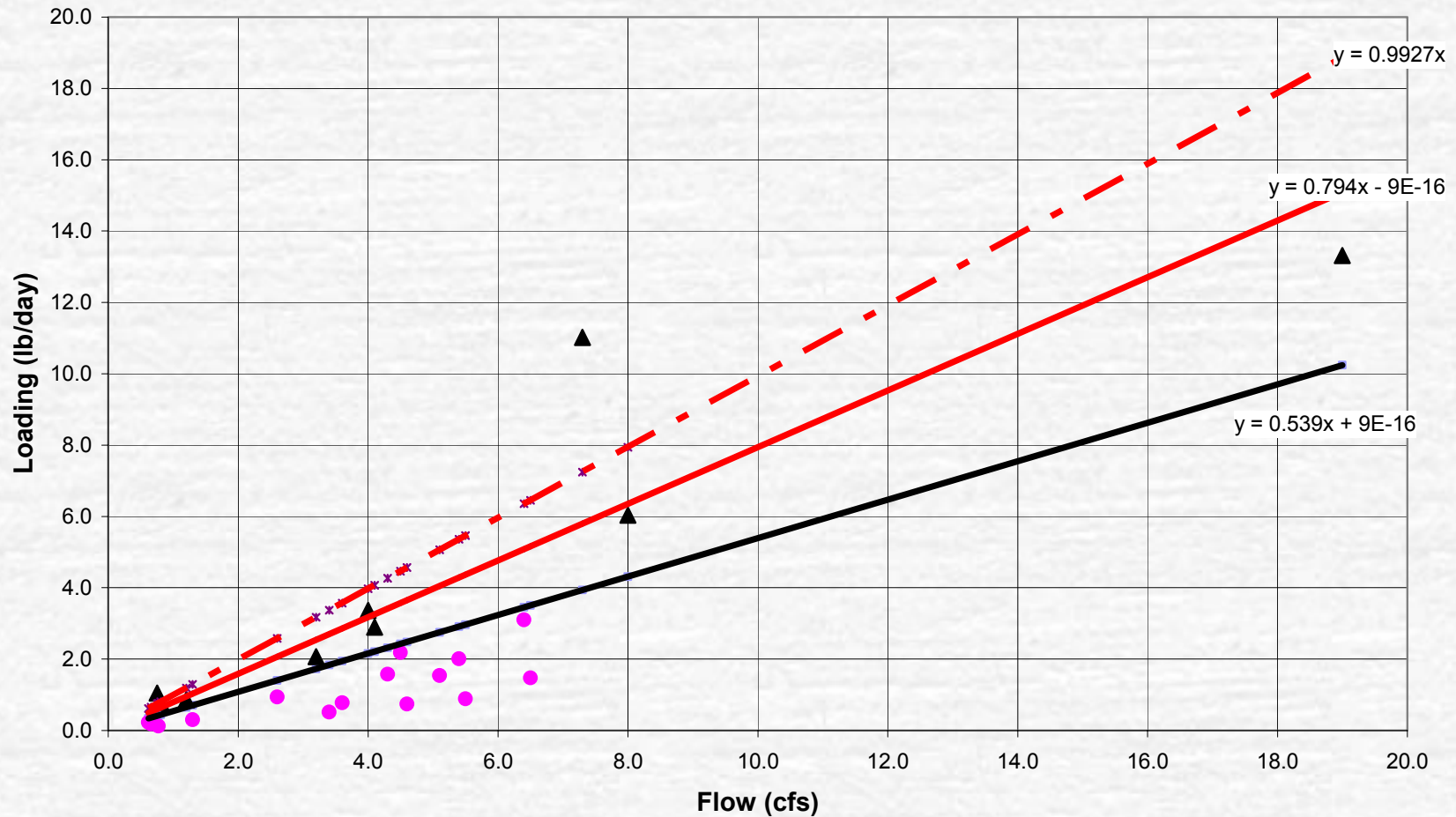
Flow-Integrated Reduction of Exceedances



● Observed Loadings ▲ Observed Exceedances - - - Exceedance Regression — Target Loading — Upper 95% CL of Slope

Coles Brook

Flow-Integrated Reduction of Exceedances




● Observed Loadings ▲ Observed Exceedances — Exceedance Regression — Target Loading - - - Upper 95% CL of Slope

Load Capacity

- The Load Capacity of the waterbody is calculated by comparing the Exceedance Regression line to the Target Loading line, including a Margin Of Safety (MOS)
- MOS is derived from the difference between the slopes of the Upper 95 percent confidence limit of the Exceedance Regression and the Exceedance Regression line and becomes an unallocated portion of the Load Capacity



Load Reduction

- The Overall Load Reduction required is calculated based on the difference between the slopes of the Upper 95 percent confidence limit of the Exceedance Regression and the Target Loading lines.
- 

Allocating Load Reduction

- Existing load is calculated by applying loading (or export) coefficients, which represent annual average loads from various land uses, to the areal extent of each land use in the drainage area, determined using GIS
- WLAs and LAs are then derived from the allocable load, with LA reductions taken only from land uses where reductions are feasible
- No reduction is taken from forest, wetland, water and barren land uses; these load contributions remain unchanged between existing and future scenarios

UAL Methodology

Pollutant Export Coefficients obtained from literature sources are applied to land use patterns:

- Land Use determined by NJDEP's 1995/97 and National Land Cover Data (NLCD) for New York (July 2000) GIS Coverages.
- Phosphorus export coefficients selected for NJ from an extensive database to develop table on next slide.

Phosphorus export coefficients (Unit Areal Loads)

Land use/Land cover	LU/LC codes ^[1]	USGS Grid_code	UAL (kg TP/ha/yr)
Mixed density residential	1100	n/a	1.2
Medium / high density residential	1110, 1120, 1150	22	1.6
Low density / rural residential	1130, 1140	21	0.7
Commercial	1200	23	2.0
Industrial	1300, 1500	n/a	1.7
Mixed urban / other urban	other urban codes	85	1.0
Agricultural	2000	81, 82	1.5
Forest, wetland, water	1750, 1850, 2140, 2150, 4000, 5000, 6000, 7430, 8000	11, 41, 42, 43, 91, 92	0.1
Barren land	7000	32	0.5

^[1] LU/LC code is an attribute of the land use coverage that provides the Anderson classification code for the land use. The Anderson classification system is a hierarchical system based on four digits. The four digits represent one to four levels of classification, the first digit being the most general and the fourth digit being the most specific description.

Segment ID No. 01377500
Pascack Brook at Westwood

Segment ID No. 01377499
Musquapsink Brook at River Vale


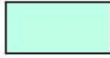


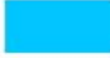





Segment ID No. 01378560
Coles Brook at Hackensack

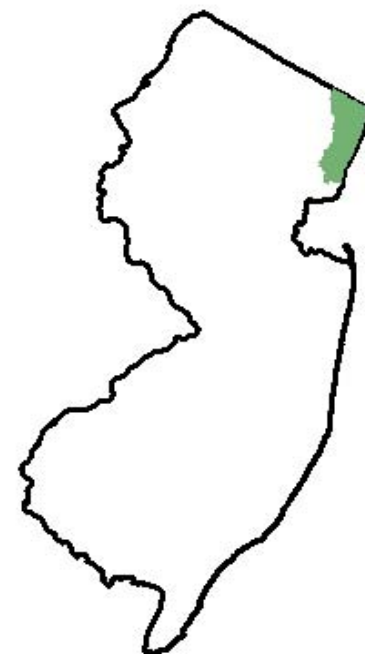


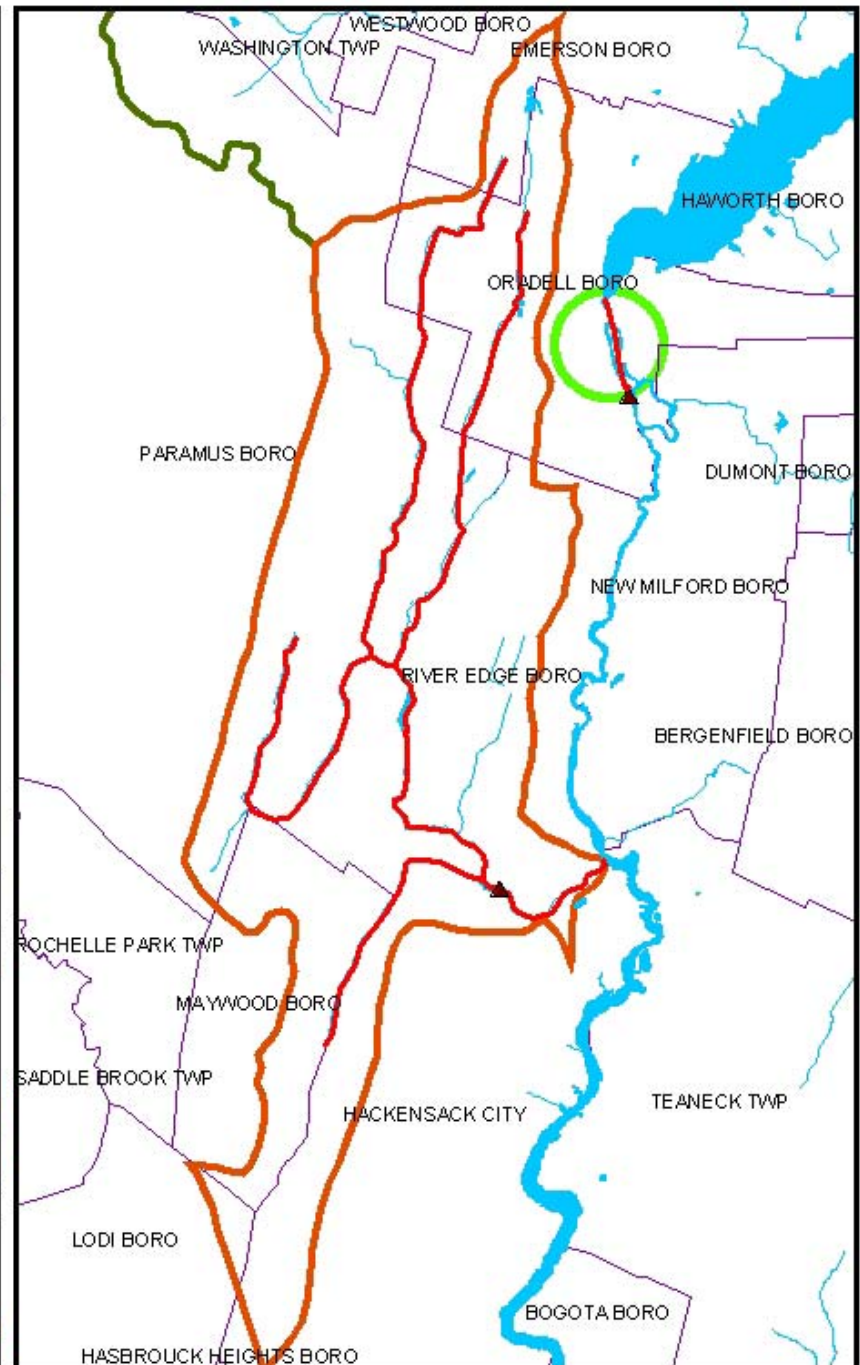
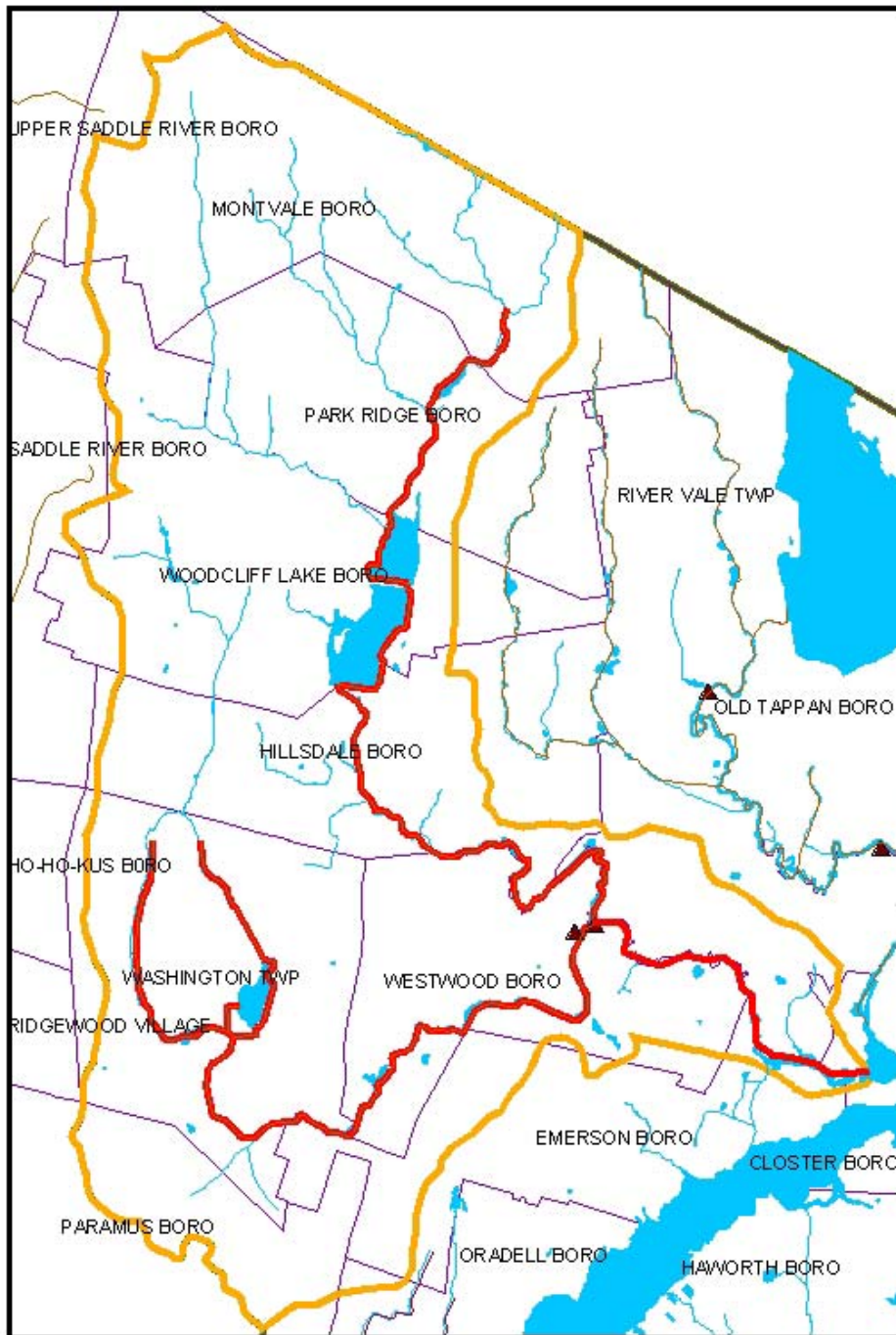
0 1 2 4 Miles

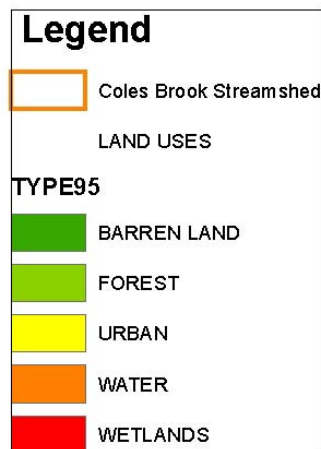
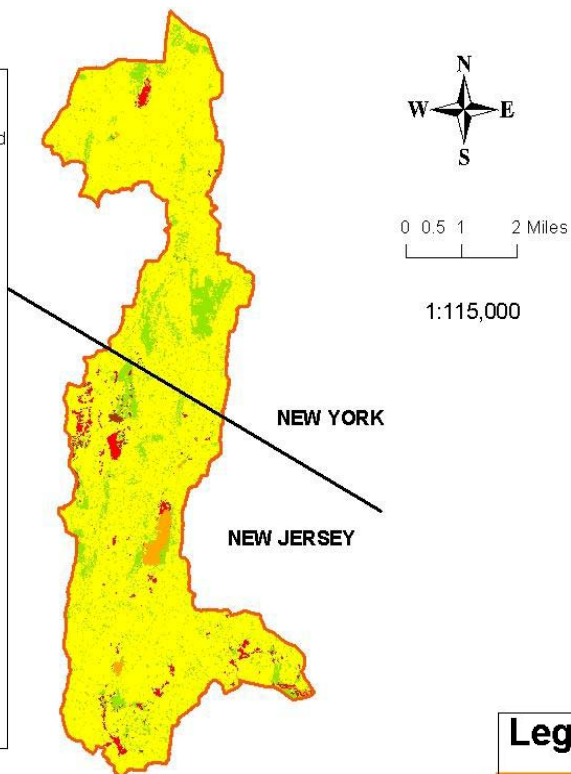
1:250,000

Legend

-  WMA 5 Boundary
-  New York, Rockland County
-  New York Streams
-  WMA 5 Streams
-  WMA 5 Lakes
-  WMA 5 Stations
-  Coles Brook Streamshed
-  Coles Brook Impaired Segment
-  Pascack/Musquapsink Streamshed
-  Pascack/Musquapsink Impaired Segment







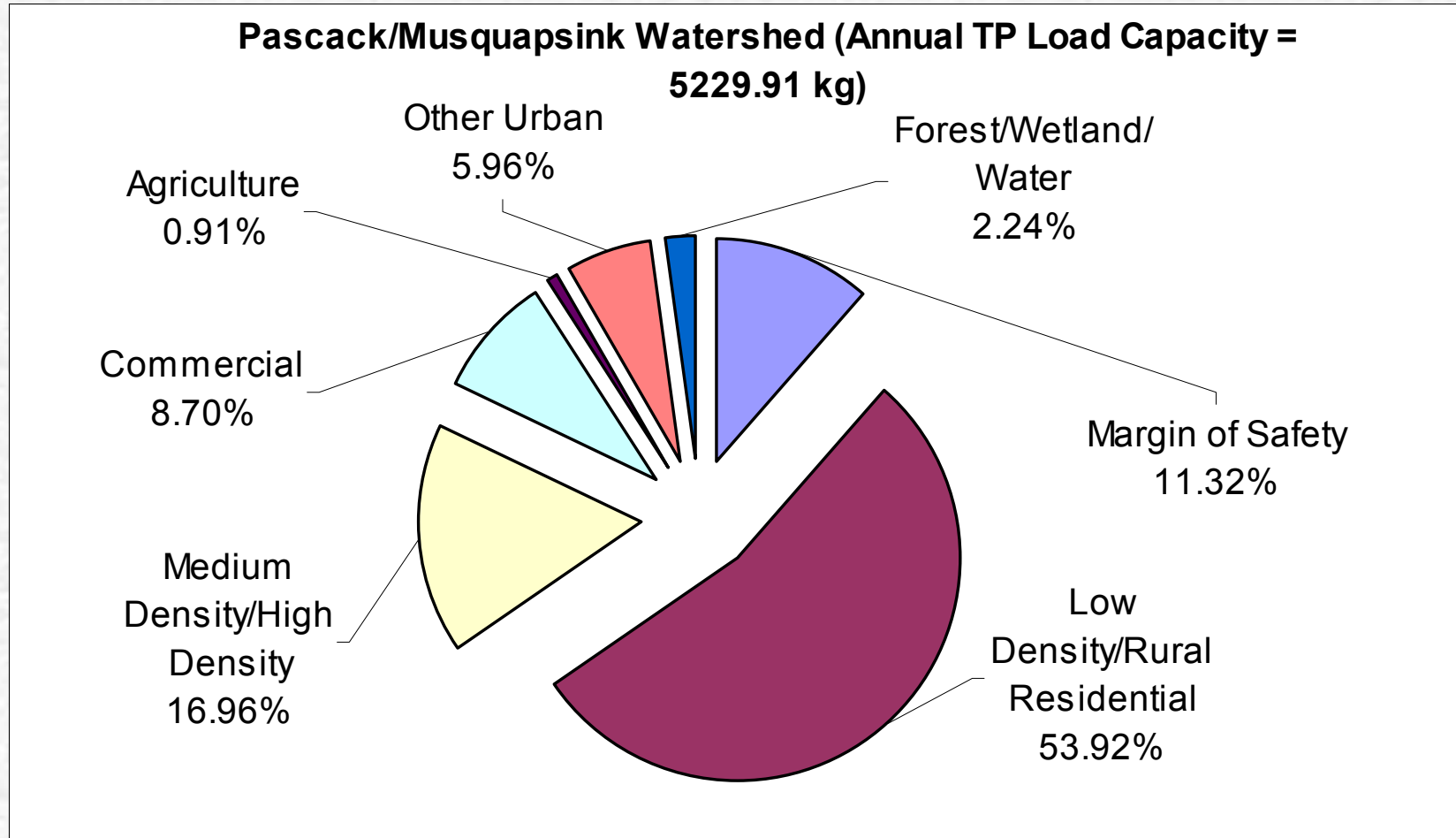
Pascack Brook

	kg TP/yr	% of Load	
Impaired Stream Calculated Load	5871.02	100%	n/a
Loading capacity (LC)	5229.91	89.08%	n/a
Load allocation (LC-MOS)	4637.88	79.00%	n/a
Point Sources other than Stormwater	n/a		
Nonpoint and Stormwater Sources	kg TP/yr	% of LC	% Reduction
Medium / high density residential	886.95	16.96%	21.43%
Low density / rural residential	2819.90	53.92%	21.43%
Commercial	455.04	8.70%	21.43%
Industrial	0	0%	21.43%
Mixed urban / other urban	311.48	5.96%	21.43%
Agricultural	47.45	0.91%	21.43%
Forest, wetland, water	117.09	2.24%	0%
Barren land	0	0%	0%
Margin of Safety	592.03	11.32%	n/a

Coles Brook

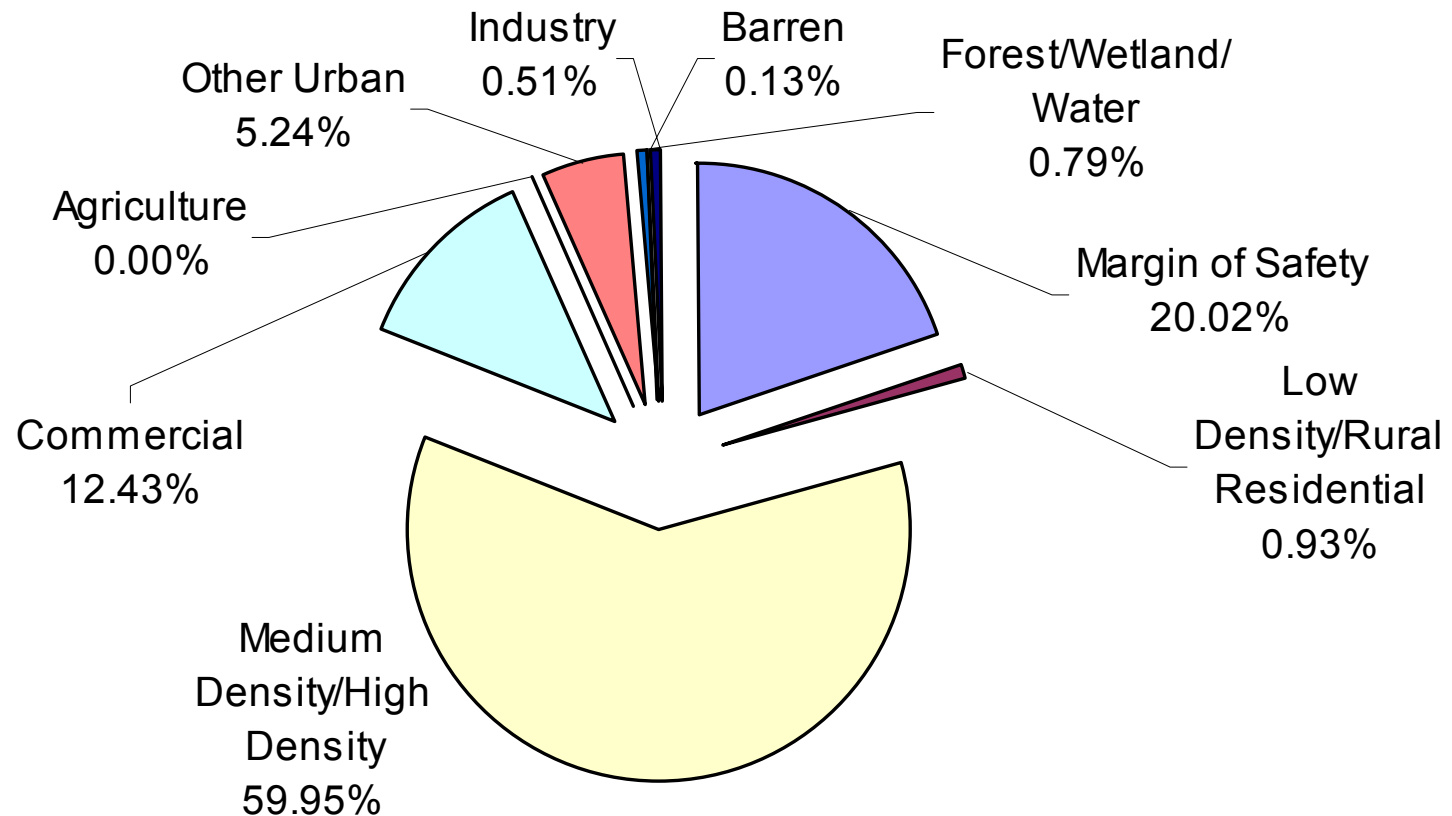
	kg TP/yr	% of Load	
Impaired Stream Calculated Load	2566.41	100%	n/a
Loading capacity (LC)	1742.08	67.88%	n/a
Load allocation (LC-MOS)	1393.32	54.29%	n/a
Point Sources other than Stormwater	n/a		
Nonpoint and Stormwater Sources	kg TP/yr	% of LC	% Reduction
Medium / high density residential	1004.40	59.95%	46.00%
Low density / rural residential	16.17	0.93%	46.00%
Commercial	216.62	12.43%	46.00%
Industrial	8.90	0.51%	46.00%
Mixed urban / other urban	91.23	5.24%	46.00%
Agricultural	0	0%	46.00%
Forest, wetland, water	13.83	0.79%	0%
Barren land	2.17	0.12%	0%
Margin of Safety	348.76	22.63%	n/a

Phosphorus Allocations by Land Use




Phosphorus Allocations by Land Use

Coles Brook Watershed (Annual TP Load Capacity = 1742.08 kg)





TMDL Implementation (Point Sources)


- For TMDL purposes, point sources include discharges to surface water that are subject to regulation under the Clean Water Act, National Pollutant Discharge Elimination System.
 - Point source reductions are accomplished through NJPDES permits: effluent limits or Phase II stormwater basic requirements, as well as additional measures, if appropriate
- 

TMDL Implementation (Non-Point Sources)

- For TMDL purposes, nonpoint sources are those that are not subject to regulation under NPDES, including NJPDES Tier B municipal stormwater discharges
- Nonpoint source reductions are achieved through implementation of management measures that can reduce loads, e.g. land use BMPs, NJPDES basic requirements and additional measures applied to Tier B municipal stormwater dischargers, etc.



Resources for Implementation

- Agricultural BMPs: EQIP, CRP, CREP
 - 319(h) grants for nonpoint source projects
 - Environmental Infrastructure Financing Program loans
 - Estuary Programs
 - Private grant programs
- 

Summary

Phosphorus Loads for Pascack/Musquapsink Watershed/impaired segment

- Based on Land Use Coefficients:
 - Annual Loading = 5871.02 kg/year
 - Loading Capacity = 5229.91kg/year (TP not to exceed 0.1 mg/L)
- Load Reduction required:
Overall **TP Load reduction 21.43 %** (including MoS)

Phosphorus Loads for Coles Brook Watershed/impaired segment

- Based on Land Use Coefficients:
Annual Loading = 2566.41 kg/year
Loading Capacity = 1742.08 kg/year (TP not to exceed 0.1 mg/L)
- Load Reduction required:
Overall **TP Load reduction 46%** (including MoS)

Conclusion



All TMDL documents are posted at
<http://www.state.nj.us/dep/watershedmgt/tmdl.htm>

Comments are due within 15 days from the date of the
public hearing (August 9, 2005) to:

Barbara Hirst, Bureau Chief
NJDEP – DWM
PO Box 418
Trenton, NJ 08625